BRIEFER ARTICLES

A PARASITIC ALGA, *RHODOCHYTRIUM SPILANTHIDIS* LAGERHEIM, IN NORTH AMERICA

During February, 1908, Dr. F. L. STEVENS, of the North Carolina Agricultural College, sent me a few dried leaves of the common ragweed, *Ambrosia artemisiaefolia*, which contained a very interesting parasite. Externally it suggested the appearance of a Synchytrium, because of the numerous minute red dots distributed beneath the surface on the petioles and veins of the leaf and on the stem, although there was no gall formation similar to that caused by species of the Synchytriaceae. A section of the host, however, showed clearly that it was very different from any of the members of this family. Maceration or teasing of the host tissue revealed the presence of a mycelium, and the crowded condition of the fruit bodies suggested the genus Cladochytrium. Further study proved, however, that it was a unique type, very different from members of this genus. Since the material received was dead, it was impossible to obtain the zoospores, and Dr. STEVENS kindly promised to have fresh material sent me at stated times during the summer.

Beginning in the month of June, material was collected by Mr. J. G. HALL, assistant in botany at the North Carolina Agricultural College, and mailed once a week. Entire plants were collected, the roots were washed, and then packed mostly in pasteboard boxes with wet sphagnum. In this way they reached me in two or three days after shipment in very good condition, so that some of the parasitized ragweed plants were transplanted in the open and others in pots where they continued to grow.

From a study of this material I have been able to obtain the zoospores from the temporary zoosporangia and to work out certain stages in the life-history of the parasite. While searching the literature for unique forms of plant parasites, I discovered that this plant had been described fifteen years ago.

This remarkable parasite is *Rhodochytrium spilanthidis* Lagerheim.[1] It was first discovered by LAGERHEIM in 1889 near Quito, Ecuador, and later was observed by him in other provinces of Ecuador. In Ecuador it is parasitic on the stems and leaves of a species of Spilanthes, one of the

[1] LAGERHEIM, G. DE, Rhodochytrium, nov. gen., eine Uebergangsform von den Protococcaceen zu den Chytridiaceen. Bot. Zeit. 51:43–53. *pl. 2.* 1893.

Compositae. LAGERHEIM searched diligently but in vain to find it on other genera of plants. Its discovery in North Carolina, therefore, is a matter of considerable interest, not only because it naturally occurs on a different host, but because of its existence in the north temperate zone as well as the temperate section (mountain regions) of the tropics. Its North American host, *Ambrosia artemisiaefolia*, is not very distantly related to the South American host Spilanthes, the former belonging to the section Heliantheae-Ambrosiinae, while the latter belongs to the section Heliantheae-Verbesininae.[2] The question of its distribution becomes an interesting one, as to whether it is distributed over the intervening territory of Mexico, Central America, Panama, and other tropical countries; or whether it has been by chance imported from one country to the other through commerce; or finally whether ages ago, when the territory from the southern United States to Ecuador may have had a different climate, the parasite might have existed throughout this range, but now is separated by a tropical belt. I hope that collectors may be on the lookout for it in other parts of the United States and also in the intervening tropical region. I should be very glad to receive material in order to obtain further information as to its distribution.

The form of the plant may be briefly described as follows: When mature it may be likened to a miniature flask with a long slender tortuous neck; while from the base, or from the sides or both, rhizoid-like processes extend, which branch profusely in a very peculiar and characteristic manner. In general its form might be likened to that of a giant Entophlyctis, one of the chytridiaceous endobiotic parasites of the algae. In its development the zoospore, at rest on the epidermis, germinates, the germ tube enters between the cells and moves on toward a fibrovascular bundle where it branches, the branches making their way between the cells parallel with the bundles, so that on the stem the mycelium extends both upward and downward. On the leaves the parasite is also confined to the vascular bundles. The entire mycelium at certain stages of development is crowded with a reddish-yellow oil, which at maturity of the temporary zoosporangia, or of the resting sporangia, is withdrawn along with the protoplasm into the main body of the plant. The zoosporangium rests within or on a fibrovascular bundle and arises by a swelling of the mycelium at the point where the entering germ tube branches. The sporangia vary greatly in shape. They are oval, subtriangular, elliptical, etc., and vary from 50 μ in diameter (the smaller ones on the leaf) to 200–300 μ. The terminal mycelium is provided with numerous short haustoria, many of which are applied very closely to the spiral ducts. In the resting sporangia the wall

[2] See HOFFMAN in ENGLER AND PRANTL, Pflanzenfamilien 4[5]: 220 and 226.

of the mycelium next to the fruit bodies becomes very thick, also that of the entering germ-tube, while the wall of the zoospore in all of the plants remains as a small trumpet-shaped expansion of the end of the tube on the surface of the host. Starch grains are abundant in the larger portions of the mycelium and in the sporangia. The wall of the resting sporangium consists of three layers, the inner being laid down by the protoplasm after its accumulation in the main part of the plant body, and is thus not continuous with the mycelium which, however, usually becomes plugged after the withdrawal of the protoplasm. The walls of the resting sporangia are yellow at maturity, while the content is dark red.

The temporary zoosporangia have a thinner wall than that of the resting sporangia, and at maturity develop a stout exit tube, the end of which opens by a pore, the margin of which grows inward by invagination. The zoospores when swimming rapidly are elliptical in form, with the red oil in minute drops at the forward end, where are the two cilia. As they slow down they become rounded and are 8–10 μ in diameter.

LAGERHEIM considered this plant to be an alga devoid of chlorophyll, though LINDAU[3] says that on account of the lack of chlorophyll it cannot be classed with the algae.

The alga to which Rhodochytrium appears most closely related, according to LAGERHEIM, is Phyllobium, discovered by KLEBS[4] (*Phyllobium dimorphum* in leaves of *Lysimachia nummularia* and more rarely in *Ajuga reptans*, *Chlora serotina*, and *Erythraea centaurium; Phyllobium incertum* in dead Carex leaves). It is an intercellular parasite and *P. dimorphum* has also a definite relation to the vascular bundles. In this species the enlarged portion of the plant body contains chlorophyll in the protoplasm, as well as a reddish-yellow oil and starch. The branched rhizoid processes are devoid of chlorophyll. Resting spores only are known. They are packed with the reddish-yellow or orange-red oil and starch and possess a thick wall with several layers. The zoospores are biciliate.

A more extended paper is in preparation, dealing fully with the question of development, morphology, physiology, and cytology of this remarkable plant. This note is published in the hope that it will stimulate a search upon the ragweed and other possible hosts for this parasite, and I should consider it a great favor to receive material from different observers in case it is found.—GEO. F. ATKINSON, *Cornell University.*

3 ENGLER AND PRANTL, Pflanzenfamilien 1^{1**}:528. 1900.

4 KLEBS, G., Beiträge zur Kenntniss niederer Algen formen. Bot. Zeit. **39**:249–257, 265–272, 281–290, 297–308, 313–319, 329–336. *pls. 3, 4.* 1881.